

Therapeutic Architecture and War Trauma: A Literature Review Toward the Design of a Psychosocial Rehabilitation Center

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Abstract: Architectural design bears a major responsibility in creating health spaces dedicated to the reconstruction of victims of conflict. Rehabilitation centers, conceived for individuals with a fragile psyche, require calm and regenerative environments that foster dignified social reintegration. This article presents a systematic literature review structured around four interconnected axes: the foundations of architectural programming; the historical and spatial principles of therapeutic architecture; the neurobiological and clinical understanding of war trauma and exile; and the theoretical and architectural framework of psychosocial rehabilitation. Drawing on architectural theory, environmental psychology, trauma studies and evidence-based design, and supported by a comparative analysis of three international precedents, the Vejle Psychiatric Hospital, the Hangzhou Social Welfare Institute No. 1, and the Tambacounda Hospital, the review identifies the spatial devices most consistently associated with emotional stabilization: wayfinding legibility, controlled exposure, withdrawal spaces, public-transition-private gradation, prospect-refuge balance, calming materiality, indoor-outdoor continuity and the presence of nature. The article demonstrates that trauma does not follow mechanically from violent exposure, since its effects depend on subjective experience and context, which imposes an adaptable, non-stigmatizing architecture offering genuine choices of use. These findings establish the theoretical foundation for the design of a psychosocial rehabilitation center for war refugees in the peri-urban area of Maroua, Cameroon.

Keywords: *Therapeutic Architecture; War Trauma; Psychosocial Rehabilitation; Refugees; Trauma-Informed Design; Evidence-Based Design; Healing Environments; Cameroon.*

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I. INTRODUCTION

Architectural design carries a major responsibility in the creation of health spaces dedicated to the reconstruction of victims of conflict. Rehabilitation centers, conceived for individuals with a fragile psyche, require calm and regenerative environments that foster dignified social reintegration. Beyond its primary function, architecture must now work to lift the taboos associated with war trauma by favoring, through spatiality alone, the acceptance of invisible wounds. Therapeutic architecture, through its specific spatial devices and its patient-centered approach, offers a concrete response to these imperatives of emotional stabilization.

To deepen this theme, which combines traumatology, psychiatric care and psychosocial rehabilitation, this literature review analyzes the neurobiological mechanisms of shock, the standards of the World Health Organization and the design principles that favor healing. It concludes with the examination of analogous case studies with impactful architectural characteristics. The central question guiding this review is: how can the theoretical and technical foundations of therapeutic architecture be articulated with the clinical understanding of war trauma to conceive a psychosocial rehabilitation center capable of supporting the emotional stabilization and social reintegration of refugees in a peri-urban Cameroonian context.

This review is structured around four complementary axes. It first examines the foundations of architectural programming, which condition the identification of needs, constraints and functions prior to any formal design response. It then traces the historical evolution and the spatial devices of therapeutic architecture. It subsequently analyzes the clinical and social dimensions of war trauma and exile. Finally, it develops the theoretical and architectural framework of psychosocial rehabilitation, before concluding with a comparative analysis of three international architectural precedents whose principles are transposable to the Cameroonian context.

II. FOUNDATIONS OF ARCHITECTURAL PROGRAMMING

Architectural programs make it possible to identify the needs, constraints, objectives and relationships necessary before searching for a formal solution [1]. They are not limited to a list of rooms, since they also integrate the activities and events that give spaces their meaning [2]. Taking recurring practices into account also allows design to be brought closer to the real uses of the people concerned [3]. Architectural programs thus lead to the study of a building's function, then the typology of programs.

➤ Building Function

The function of a building rests on solidity, utility and architectural quality, in accordance with the principles formulated by Vitruvius [4]. It relates to use, security and comfort, but also to the environmental health function, the structural health function, the occupant health function, and the sustainability function of the building.

- *Function of Use:*

The function of use concerns the adaptation of spaces to activities, body dimensions and occupant movement. Anthropometric data determine the dimensions required for furniture, postures, movements and circulation [5]. Interpersonal distances also influence how people accept proximity and use shared or private spaces [6]. The relationship between space and the events that unfold within it further calls for organizations capable of accompanying the evolution of practices [2].

- *Security Function:*

The security function concerns the protection of occupants and the control of situations liable to produce danger. The distinction between public, semi-public, semi-private and private spaces facilitates the identification of territories and their control by users [7]. The possibility of naturally observing accesses and circulation also contributes to the surveillance of places [7]. Protective devices must nonetheless remain integrated into the architecture so that security does not transform the space into an environment organized solely around threat [8].

- *Comfort Function:*

The comfort function concerns the thermal, luminous, acoustic and atmospheric conditions in which a building is used. Orientation, envelope, solar protection and ventilation

allow the building to be adapted to local climatic characteristics [9]. Natural light contributes to the visual quality of spaces and limits reliance on artificial lighting [10]. Acoustic treatment reduces noise nuisance and improves listening conditions as well as privacy [11]. Temperature, humidity and air renewal complete the main components of indoor comfort [12].

- *Environmental, Structural and Occupant Health, and Sustainability:*

The environmental health function concerns the limitation of a building's effects on natural resources and its site of implantation, notably through the origin, transformation, transport, maintenance and end-of-life of materials [13], and through life-cycle analysis of resource consumption and impacts [14]. The structural health function concerns the conservation of a building's physical integrity and the prevention of degradation [15]. The occupant health function concerns the effects of the indoor environment on physical and psychological well-being, including air quality, ventilation, humidity, thermal comfort, lighting and acoustics [12], as well as the emissions of materials and equipment [15]. Finally, the sustainability function corresponds to a building's capacity to preserve its performance and integrity throughout its life cycle, depending on design quality, material resistance and the control of degradation [16], as well as the reduction of resource consumption across construction, use, maintenance and end of life [14].

➤ Program Typology

Program typology groups buildings according to characteristics and requirements common to their design. It can rely on the principal destination of buildings through functional typology, but also on the transformation of architectural conceptions through evolutionary typology [1].

- *Functional Typology:*

Functional typology distinguishes residential buildings, health establishments and educational infrastructures according to the nature of the activities they host [5]. Psychosocial rehabilitation centers support the recovery, autonomy and social participation of people living with psychological difficulties [17]. Their organization can combine reception, waiting, consultation, assessment, therapeutic activities and staff spaces [18].

- *Evolutionary Typology:*

Evolutionary typology first follows the principles of modern architecture, marked by constructive rationality [19]. The Villa Savoye illustrates this approach through its independent structure, free plan and spatial organization, as shown in Fig. 1.



Fig 1 Villa Savoye, Poissy.
Source: Fondation Le Corbusier, n.d.

It then considers the challenges raised by post-modern architecture, notably the reintroduction of complexity and historical references [20], before extending to contemporary therapeutic architecture, more attentive to the relationships between the built environment, nature and occupant well-being [21]. Biophilic design favors natural light, vegetation, views to the exterior and connections with natural systems [21]. The Khoo Teck Puat Hospital illustrates this orientation through its integration of gardens and vegetated spaces, as shown in Fig. 2.



Fig 2 Khoo Teck Puat Hospital, Singapore.
Source: Wikimedia Commons, 2025; CPG Corporation, n.d.

III. THERAPEUTIC ARCHITECTURE

Therapeutic architecture designates a design approach that mobilizes knowledge relating to the effects of the built environment on health, stress, comfort and user well-being [22]. Antonovsky's sense of coherence, grounded in comprehensibility, manageability and meaningfulness, can inform the design of more predictable and understandable environments [23]. Relationships between sensory perception, emotion and physiological reaction also show that the characteristics of a place can reinforce or diminish

certain forms of stress [24]. Natural environments, for their part, present characteristics favorable to the restoration of directed attention [25].

➤ Historical Evolution

The history of therapeutic architecture shows a progressive evolution in the relationships established between care and the built environment, from antique healing sanctuaries, through reference hygienist models, to contemporary therapeutic paradigms [26]. Hospital transformations proposed in the eighteenth century reinforced the role of aeration, separation and light in the design of health establishments [27].

• Antique Healing Sanctuaries:

In antiquity, the built environment was inseparable from care. Influenced by Hippocrates, medicine rested on the balance between the body and its environment, and architecture was designed to capture the benefits of air, water and climate. Asclepieia were sanctuaries dedicated to Asclepius, in which several buildings were distributed around pathways, porticoes and open spaces. The organization of the sanctuary of Epidaurus shows the coexistence of temples, reception buildings, resting places and spaces associated with care practices [26], as shown in Fig. 3.

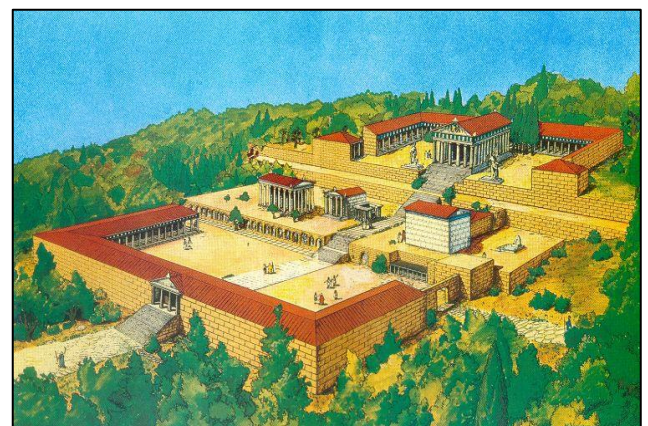


Fig 3 Site Plan of the Asclepieion of Kos.
Source: Sigerist, 1951.

Purification spaces grouped the places in which ritual preparation, rest and incubation preceded or accompanied care practices, while the therapeutic use of water occupied an important place in antique bodily practices, even though baths also fulfilled social, hygienic and cultural functions [28]. Thermal complexes organized a succession of cold, tepid and hot spaces, to which pools, resting rooms and exercise spaces could be added, regulating the bather's progression between different temperatures and practices.

• Reference Hygienist Models:

Hygienist models reinforced the role of architecture in ventilation, sunlight exposure, the separation of patients and the reduction of insalubrity, manifested in pavilion morphology, air-cure sanatoriums and the architecture of light associated with heliotherapy [27]. Pavilion morphology relies on the fragmentation of the hospital into separate buildings to facilitate aeration, lighting and the distinction

between different categories of patients, echoing the criticisms formulated regarding the density and insufficient ventilation of Parisian hospitals [27]. Air-cure sanatoriums were designed to host tuberculosis patients in environments favoring rest, outdoor air and sun exposure. The Paimio Sanatorium, designed by Aino and Alvar Aalto between 1929 and 1933, organizes rooms, terraces and collective spaces according to the needs of tuberculosis patients of that period [29], as shown in Fig. 4.



Fig 4 Air-Cure Terraces of the Paimio Sanatorium.
Source: Alvar Aalto, 1933.

The architecture of light and heliotherapy developed at a time when sun exposure was used in the treatment of certain forms of tuberculosis and rickets [30]. Large bay windows, balconies, terraces and room orientation allowed this exposure to be organized within sanatoriums, and these devices also influenced certain characteristics of modern architecture, notably the opening of facades and the search for light-filled spaces.

- *Contemporary Paradigms:*

Contemporary paradigms of therapeutic architecture correspond to approaches studying the relationships between the built environment and outcomes observed among users, comprising Evidence-Based Design, which structures design decisions from verifiable knowledge, and the study of environmental effects on well-being, safety and recovery [22]. According to Cama, space must be considered an element influencing the comfort, recovery and well-being of users [22], a theoretical framework presented in Evidence-Based Healthcare Design, whose cover is shown in Fig. 5.

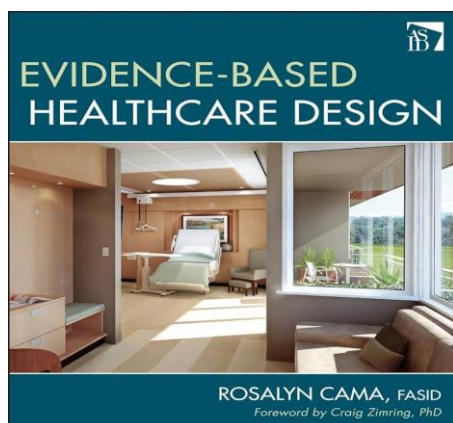


Fig 5 Cover of Evidence-Based Healthcare Design.
Source: Google Books, 2009 (Cama, 2009).

Environmental effects on well-being concern relationships observed between certain characteristics of the built environment and the experience of patients, relatives or staff. Light, views, noise, room organization and access to nature figure among the factors studied in research on health establishments [31]. A study of forty-six surgical patients notably observed better recovery conditions among those whose room overlooked trees than among those whose view was oriented toward a brick wall [32], a relationship between the integration of nature and improved well-being illustrated in Fig. 6.



Fig 6 Healthcare Environments Integrating Nature and Daylight.

Source: Architecture Now, 2025; Forest Homes, 2025.

- *Healing Spatial Devices*

Therapeutic spatial devices designate the organizations and architectural characteristics likely to support safety, comfort and quality of experience in care environments, comprising sensory atmospheres, the configuration of psychological security, and the relationship with nature [33]. These devices must be adapted to the populations received, the model of care and the functioning of the establishment [18].

- *Sensory Atmospheres:*

Sensory atmospheres correspond to the visual, sonic and material characteristics perceived by occupants. Visual chromatic qualities concern relationships between colors, light, contrast and the perception of space; in health establishments, colors can contribute to zone differentiation, visibility and wayfinding, but their effects depend on context, lighting and user characteristics [34]. Acoustic quality concerns the control of exterior noise, equipment, conversations and reverberation; World Health Organization recommendations identify noise as a factor liable to disturb sleep, communication and rest, while setting different levels according to rooms and periods considered [35]. Tactile quality of materials mobilizes visual, tactile and affective dimensions, although positive psychological effects cannot be generalized without caution [36]; in a care environment, materials must also meet requirements of safety, cleaning, durability and maintenance.

- *Configuration of Psychological Security:*

The configuration of psychological security designates a spatial organization intended to limit disorientation,

excessive exposure, unpredictability and loss of control, resting on the prospect-refuge principle, the legibility of pathways and the hierarchy of privacy thresholds. Trauma-informed approaches notably give an important place to safety, trust, choice and the agency of the persons received [37]. The prospect-refuge principle distinguishes the possibility of observing one's environment from the possibility of disposing of spatial protection [38], as shown in Fig. 7.



Fig 7 Application of Prospect-Refuge Theory in a Hospital Space.

Source: Appleton, 1975.

The legibility of pathways concerns users' ability to understand their position, identify a destination and choose a route; a clear organization, useful perspectives, limited changes of direction and identifiable landmarks facilitate orientation in complex buildings [39]. At the Khoo Teck Puat Hospital, circulation is organized around long, luminous perspectives opening onto interior gardens, serving as permanent spatial landmarks, as shown in Fig. 8.

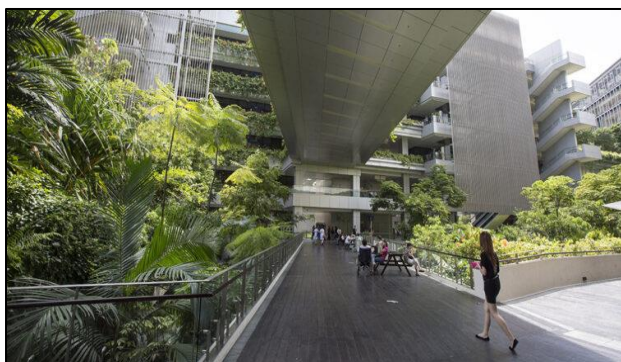


Fig 8 Circulation at the Khoo Teck Puat Hospital.

Source: CPG Corporation, n.d.

The hierarchy of privacy thresholds corresponds to a progression between spaces accessible to the public, collective areas, accompaniment zones and private spaces, protecting confidentiality, controlling access and avoiding an imposed proximity between incompatible activities [18].

- *Relationship with Nature:*

The relationship with nature groups the different ways of introducing a natural experience into care environments, comprising horticultural therapeutic gardens, the indoor-

outdoor continuum, and the psychophysiological effects of landscape. Available research shows a broadly positive relationship between green or blue spaces and several dimensions of mental health, while underlining the diversity of contexts and the need not to generalize each result [18]. Regenerative horticultural gardens are outdoor spaces designed to allow rest, walking, observation or participation in horticultural activities, their design accounting for accessibility, safety, shade, pathways, seating and the needs of the populations received [40]; a meta-analysis observed positive associations between gardening practice and several health indicators, without attributing the same effects to all gardens or all populations [41], as illustrated in Fig. 9.



Fig 9 Therapeutic Garden of the Arizona Cancer Center at UMC North.

Source: Healing Landscapes Network, n.d. (Ten Eyck Landscape Architects).

The indoor-outdoor continuum corresponds to the visual, physical or functional continuity established between built spaces and exterior spaces; windows, patios, terraces and circulation extensions can allow a natural environment to be observed or reached, a naturalistic view being associated with certain favorable indicators of recovery in a specific postoperative context [32]. The psychophysiological effects of landscape concern the emotional, physiological and cognitive reactions associated with exposure to certain natural environments; an experiment observed a faster stress recovery when natural scenes were presented than when urban scenes were presented [42], while attention restoration theory indicates that natural environments present characteristics favorable to the recovery of attentional fatigue [25].

IV. WAR TRAUMA

War trauma designates psychic harm that can appear when a person fails to process or integrate the thoughts and emotions provoked by a violent experience. This experience can be unique, repeated or multiple, and its effects depend on the person's reaction as well as the meaning they attribute to it [43]. Its understanding has been constructed over the course of conflicts and accounts for the nature of the event, the mode of exposure, and the evolution of manifestations from the acute phase to durable forms.

➤ *Historical Evolution of War Trauma*

The history of war trauma shows a progressive evolution in the terms used to designate the psychic harm provoked by conflicts. Observed disorders were associated with bombardment trauma during the First World War, war neurosis during the Second World War, and combat stress during the Vietnam War [44], an evolution that progressively shifted these manifestations from the status of individual weakness to that of a disorder recognized by medicine.

The First World War marked an important stage in the recognition of psychic trauma provoked by conflict; the scale of disorders observed among soldiers led the fifth International Psychoanalytic Congress, held in Budapest in 1918, to devote its work to war neuroses [45]. The Second World War confirmed the psychic effects of prolonged exposure to combat, with bombardments, persecutions and forced displacement extending the question of trauma to civilian populations [44]. The Vietnam War constitutes a turning point in the diagnostic recognition of war trauma: the increase in cases observed after the return of veterans contributed to the introduction of post-traumatic stress disorder into the American classification of mental disorders in 1980 [46].

➤ *Potentially Traumatic War Events and Modes of Exposure*

A potentially traumatic war event corresponds to a situation liable to produce psychic harm, without this consequence being systematic; the same event can be experienced differently according to the personality, beliefs, values and prior experiences of each person [44]. Its forms vary according to intensity, repetition and inscription in time, distinguishing a unique experience, a repeated experience, and multiple experiences that eventually overwhelm the person [43], as well as the accumulation of events of varying importance [47] and the recall of an old event with traumatogenic potential [44]. Psychic war trauma corresponds to the harm that occurs when the violent experience exceeds a person's capacity to process and integrate the thoughts or emotions it provokes [43], effects that must also be understood in light of the social and political context in which isolation, stigmatization and the rupture of ties occur [47].

The mode of exposure to war violence specifies the person's position relative to the event: direct exposure concerns a person who personally suffers violence or is present at the moment of the event, associated with combat operations and life-threatening situations [44], while indirect exposure concerns a person affected by an event they did not themselves suffer or observe directly, as when a family is affected by an experience lived by one of its members [43].

➤ *Acute and Long-Term Phases*

The acute phase of war trauma begins at the moment of the event and continues over the following days, distinguishing an immediate reaction limited to the first hours and a post-immediate period that can extend until the end of the first month [48]. Immediate reactions comprise normal adaptive stress reactions, overwhelmed stress reactions that

disorganize conduct, and acute psychopathological reactions in cases of greater disorganization [48]. The long-term phase involves durable alterations of psychic functioning, corresponding to persistent changes in how a person perceives themselves, understands their environment and relates to others, alterations that can also affect identity landmarks, trust and inscription within the collectivity [47].

➤ *War Exile*

War exile begins with a forced departure that ruptures the framework of life and continues in a place of reception where physical protection does not always guarantee immediate stability, organized around uprooting, flight, arrival and the difficulties of adaptation [49]. Forced departure corresponds to the abandonment of housing, activities, relationships and the landmarks that structured daily life, flight representing a period of uprooting during which the search for safety becomes a priority [49], as illustrated in Fig. 10.

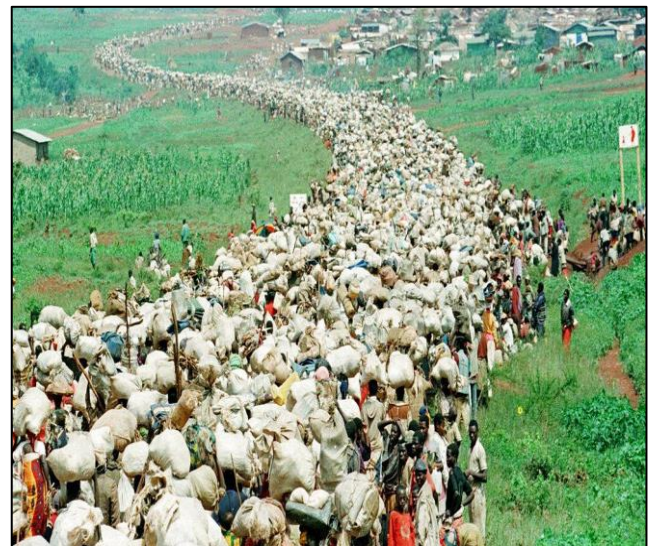


Fig 10 Forced Displacement and Rupture of the Living Environment.

Source: Online image archive (Bing Images), 2026.

Access to a place of reception ends part of the danger without ensuring immediate stabilization, arrival opening a period marked by procedures, waiting and adaptation to a new environment [49], accompaniment needing to account for essential needs, protection and community support [50]. Secondary victimization appears when the reactions of institutions, services or the entourage aggravate the suffering caused by the initial event, through a lack of understanding, questioning of the account, or absence of choice [43]. Psychic suffering in the context of exile can result from violence experienced before departure, dangers encountered during flight, and difficulties present in the place of reception, refugees being affected by sleep disorders, social isolation and prior traumatic experiences, while suffering cannot be separated from the social and political conditions in which reception unfolds [51], as illustrated in Fig. 11.



Fig 11 Sahrawi Refugee Camp.
Source: La Libre Afrique, 2017.

Ulysses syndrome, linked to migratory grief, designates a suffering associated with chronic and multiple migratory stress, related to the accumulation of family separation, isolation, fear, uncertainty and survival difficulties [52]; this suffering does not necessarily constitute a psychiatric illness, but reflects a saturation of adaptive capacities in the face of persistent losses and constraints.

Psychological first aid in a humanitarian context constitutes immediate assistance intended for people confronted with a serious crisis, defined as humane, practical assistance respectful of the person's dignity and culture [53], resting on listening, protection, the identification of immediate needs and orientation toward available resources without imposing a detailed account of the event; the person must retain the choice to speak or remain silent so as not to aggravate their suffering [54]. Specialized care in the context of exile becomes necessary when manifestations are severe, persistent, or prevent the person from carrying out daily activities, a framework proposed for the assessment and management of acute stress, depression, post-traumatic stress disorder and other conditions encountered in humanitarian situations [55], as illustrated in Fig. 12.

➤ *Intergenerational Trauma*

Intergenerational trauma corresponds to the effects that experiences lived by one generation can produce on the next; this transmission can pass through parents' mental health, family relationships, educational practices, narratives and silences [56], resting on several relational, social and sometimes biological mechanisms without being automatic [57], as illustrated in Fig. 12.

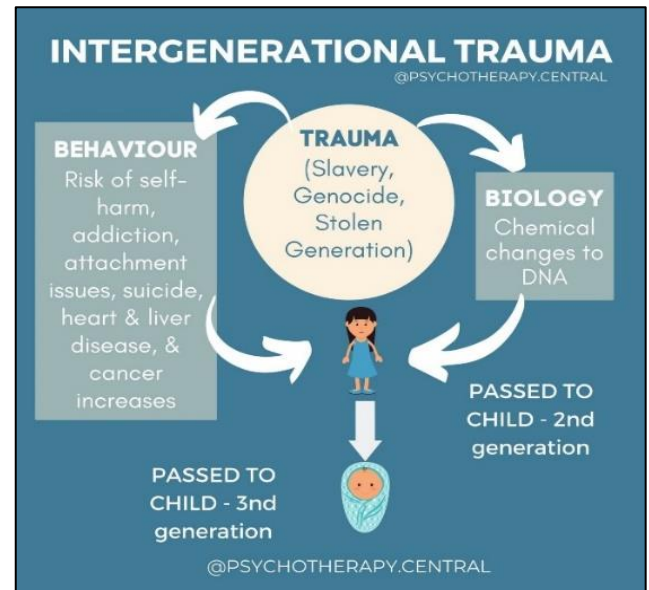


Fig 12 Intergenerational Trauma.
Source: Online image archive (Bing Images), 2026.

➤ *Medical Nomenclature*

Medical nomenclature groups the systems used to describe and classify mental disorders. The International Classification of Diseases is developed by the World Health Organization, while the Diagnostic and Statistical Manual of Mental Disorders is published by the American Psychiatric Association [58]; the eleventh revision of the International Classification of Diseases distinguishes post-traumatic stress disorder from complex post-traumatic stress disorder, and organizes diagnostic criteria around three central groups: the re-experiencing of trauma in the present, corresponding to the involuntary return of the event through memories, nightmares or flashbacks; persistent avoidance, corresponding to efforts made to avoid thoughts, emotions, people, places or situations associated with the event; and the durable perception of threat, corresponding to the maintenance of a state of alertness despite the disappearance of immediate danger, associated with hypervigilance and an increased startle reaction [59].

V. PSYCHOSOCIAL REHABILITATION

Psychosocial rehabilitation designates a process that facilitates, for people whose functioning is limited by a psychic disorder, the attainment of an optimal level of autonomy within the community, acting both on the development of individual capacities and on the resources present in the person's living environment [60]. It relies on principles that orient the place given to the person, develops along a pathway adapted to their situation, and takes place within structures whose functioning and architecture must support their return to an autonomous and social life [17].

➤ *Foundations*

The foundations of psychosocial rehabilitation give a central place to the capacities, preferences and agency of the person rather than to their limitations alone [61], and presuppose the restoration of a feeling of security allowing the disorganization provoked by the traumatic experience to

be reduced [62]. They then accompany the reconstruction of personal continuity, the improvement of daily functioning and the progressive resumption of a place within the community [63], understanding rehabilitation as a comprehensive approach attentive to the person, their environment and the different domains of their existence [60].

Psychosocial rehabilitation associates the development of a person's capacities with the adaptation of their environment, not limiting accompaniment to symptom reduction but also targeting autonomy, daily activities and community participation [60]; it regroups care principles and tools intended to reinforce decision-making and action capacities among people living with psychic disorders, establishing a link between care, daily functioning, social relationships and the realization of a personal life project [64]. Its principles rest on the conviction that every person possesses a potential susceptible of being developed, privileging attention to strengths rather than deficiencies, self-determination, individualized accompaniment, early intervention and the learning of skills useful to daily life [61], recognizing that a person's difficulties cannot be understood independently of their family, social, residential or professional environment [61].

Emotional stabilization corresponds to the restoration of a level of security allowing the person to better contain their reactions and progressively participate in their accompaniment, the establishment of safety constituting a preliminary step to work on traumatic memories and the reconstruction of ordinary relationships [65]; after a collective trauma, interventions must notably reinforce the feeling of safety, favor calming, support personal and collective efficacy, maintain ties and preserve hope [62]. Personal recovery designates a singular process by which a person constructs or reconstructs a life they consider satisfying despite the possible persistence of certain difficulties, comprising connection to others, hope, the reconstruction of identity, the search for meaning and the reinforcement of agency [63]. Post-conflict social reintegration corresponds to the progressive resumption of activities, relationships and roles weakened by war and exile, family and community supports constituting an essential level of the psychosocial response since they participate in the restoration of routines, social ties and the feeling of belonging [51].

➤ Process

The process of psychosocial rehabilitation organizes accompaniment from the initial understanding of the situation to the implementation of the responses agreed upon with the person, beginning with the identification of their needs, resources and difficulties, continuing through the construction of a coherent pathway, and culminating in the mobilization of interventions necessary to reach their objectives [66], a progression that is not identical for all beneficiaries since it depends on their availability, situation and life project [64], as shown in Fig. 13.

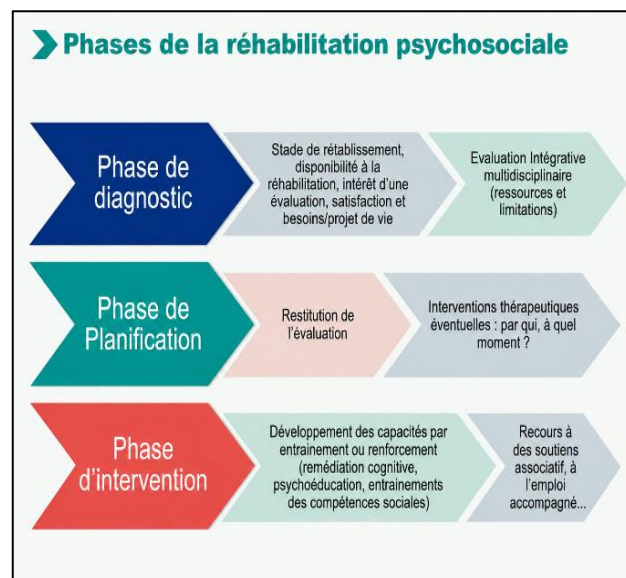


Fig 13 Phases of the Psychosocial Rehabilitation Process.

Source: Franck, 2019.

The diagnostic phase begins with an interview intended to assess the person's situation and the relevance of psychosocial rehabilitation accompaniment; the assessment concerns their stage of recovery, needs, life project, resources, limitations and readiness to engage in the proposed pathway [66]. The planning phase begins with the restitution of assessment results to the person, defining objectives, priorities, necessary interventions and the order in which actions can be implemented [66], the recovery plan needing to be elaborated with the person so that they can express their aspirations and participate in decisions concerning their pathway [67]. The intervention phase corresponds to the implementation of the pathway defined with the person, tools comprising psychoeducation, cognitive remediation, cognitive therapies, social skills training and actions intended to reinforce decision-making and action power [64].

➤ Center Functioning

The functioning of a psychosocial rehabilitation center situates accompaniment within a structure accessible from living places and open to the community [17], adjusting the pathway to the resources and objectives of each person, combining different forms of support, and ensuring continuity between professionals, social services, relatives and other health structures [17]. The extra-hospital structure brings mental health services closer to living places and limits the isolation produced by closed institutions, community centers being able to propose consultations, psychosocial interventions, group activities, family support and coordination with other health and social services [17]. The personalized pathway organizes accompaniment based on the needs, resources, aspirations and rhythm of each person [67], while accompaniment modalities can be individual, collective, family-based, community-based or grounded in peer support, humanitarian contexts organizing responses across several levels, from essential services and community supports to targeted interventions and specialized care [51].

➤ *Architecture of Psychosocial Rehabilitation Centers*

The architecture of psychosocial rehabilitation centers organizes the physical conditions in which reception, assessment, care and activities unfold, contributing to safety, the comprehensibility of the environment and the maintenance of a feeling of control [37]. It orders the relationships between functions, modulates degrees of openness, protects exchanges and adapts atmospheres to user needs [18], and can also offer several ways of occupying places, support social relationships and establish contact with nature.

• *Trauma-Informed Design and Functional Organization:*

Trauma-informed design accounts for the risk that certain practices or environmental characteristics reactivate a feeling of threat, powerlessness or loss of control, resting on safety, trust, peer support, collaboration, agency and the consideration of cultural and historical differences [37]. Functional organization translates a center's activities into sectors linked according to their uses, confidentiality needs and the movements they produce; an outpatient mental health unit notably comprises entrance, reception, waiting, consultation, treatment, collective therapy, daily activity and staff support spaces [18], relationships between these functions needing to be established before determining surfaces or the definitive number of rooms.

• *Access Gradation, Legibility, Privacy and Sensory Regulation:*

Access gradation organizes the progressive passage from the most open spaces toward sectors requiring greater protection or confidentiality, the separation of public functions, consultation spaces and staff-reserved zones limiting incompatible crossings while protecting certain activities [18]. Wayfinding legibility allows the person to understand where they are, where they must go and how they can leave a space, visible signage needing to connect the entrance, parking and main destination units, while frequently associated functions should be arranged to limit unnecessary movement [39]. Privacy protection concerns the confidentiality of exchanges, the control of gazes and the possibility of choosing one's degree of exposure to others, interview and consultation rooms needing acoustic confidentiality while noisy waiting spaces must be kept away from care areas [18]. Sensory regulation consists of controlling stimulations liable to increase stress, disorientation or a feeling of insecurity, sudden noises, overly intense lighting, visual clutter and imposed proximity with other people being able to aggravate distress in a care environment [33].

• *Spatial Choice, Relational Support and Nature Contact:*

Spatial choice allows the person to adapt their position to their state, need for calm and relational availability, agency and the possibility of making choices constituting fundamental principles of the trauma-informed approach [37]. Relational support favors the reconstruction of ties, participation in collective activities and the reduction of isolation, connection to others constituting a central dimension of personal recovery [63], the built environment being able to support these relationships by proposing places

allowing chosen encounters and different degrees of participation while preserving possibilities of withdrawal. Contact with nature can be ensured by views onto vegetation, access to outdoor spaces, the presence of plantings or the conduct of activities in a landscaped environment, exposure to natural environments being able to favor a greater recovery from stress than exposure to certain urban environments [42], the presence of plants in a care space also being able to improve appreciation of the environment and reduce perceived stress [68].

The effects of design on stress can be studied through a model relating environmental characteristics, the reduction of stress factors and the possible decrease of aggressive behaviors in psychiatric units, elements studied comprising density, noise, privacy, the visibility of spaces, freedom of movement, the diversity of places and access to nature [69], as presented in Fig. 14. This study concerns psychiatric hospitalization units and cannot therefore be applied directly to an entire community center intended for refugees, but it nonetheless helps understand that spatial organization can act on certain environmental conditions associated with stress.

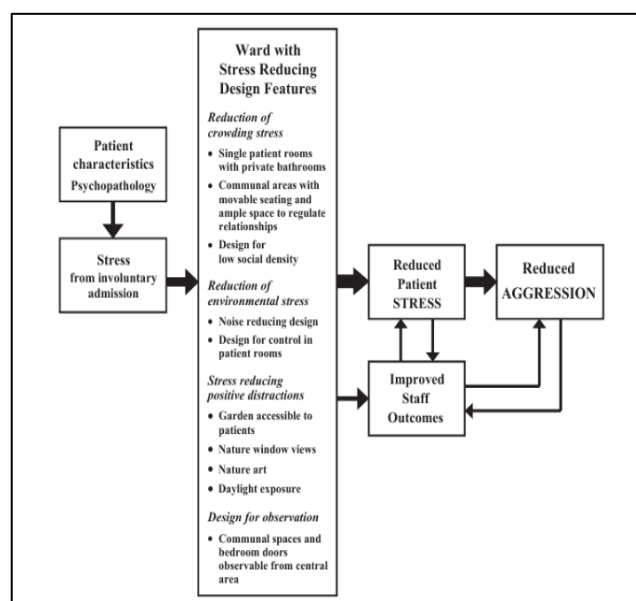


Fig 14 Model Linking Design, Stress and Aggression.

Source: Ulrich et al., 2018.

VI. ANALOGOUS ARCHITECTURAL REFERENCES

This section analyzes existing general and psychiatric health facility projects worldwide in order to better grasp their design, organization, functioning and the architectural principles governing their conception, focusing on projects whose parti, spatial organization, materials and structural choices are directly transposable to the design of a psychosocial rehabilitation center.

➤ *Vejle Psychiatric Hospital (Denmark)*

The Vejle Psychiatric Hospital, designed by Arkitema Architects and completed in 2017 on a 17,000 m2 site in Vejle, Denmark, presents a particular interest through its

complete, humanized and site-attentive spatial organization, characterized by an implantation respectful of topography, interior spaces connected to green courtyards, and calming views onto nature. The 91-bed building comprises eight grouped houses forming a circular figure, an annular logic in which these houses along with the functional and administrative building gather functions and structure an open, legible hospital. The hospital was recognized in the Mental Health Design category at the European Healthcare Design Awards 2018 [70], as shown in Fig. 15.



Fig 15 Aerial View of Vejle Psychiatric Hospital.
Source: ArchDaily, 2025.

The parti architectural rests on producing a luminous, warm and welcoming hospital environment through interconnected pavilions housing specific psychiatric services, simple geometric volumes and clean lines translating a will for clarity, while natural materials, notably wood and stone, combined with large glazed bays, reinforce visual connection with nature [71]. The hospital is structured to establish environments of trust in which patients, families and staff become explicit priorities, pavilions inserting themselves into the topography and confirming that the environment is a central element of the project, therapy zones granting strong priority to light and its therapeutic effects, and community zones being situated within vegetated interior courtyards, as shown in Fig. 16.

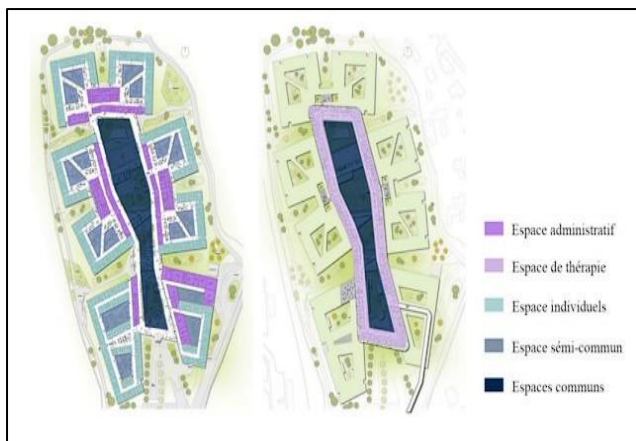


Fig 16 Spatial Organization of the Vejle Psychiatric Hospital.
Source: ArchDaily, 2025.

The design is conceived to diminish sensations of claustrophobia and the anxiety often associated with psychiatric hospitals, extroverted functions such as emergency reception and child psychiatry being arranged as welcoming units from arrival, while services are grouped toward the interior; abundant natural light, glazed panels, interior courtyards and colored light therapy support healing, sleep and the mitigation of depression [71]. Light and the management of sensory stimuli constitute two major principles applied throughout the project, materials and colors being chosen to avoid perceptual overload and install a serene setting. The proximity to railway tracks nonetheless constitutes a notable constraint, since the psychiatric department is located next to the line and train noise disturbs patients and employees present day and night.

➤ Hangzhou Social Welfare Institute No. 1 (China)

The Hangzhou Social Welfare Institute No. 1, designed by UAD Group Four and completed in 2022 on a 36,880 m² site in the Yuhang district of Hangzhou, China, is selected for its organization intended for vulnerable people requiring durable accompaniment, including undocumented persons, orphans over eighteen, and homeless people, nearly 85 percent of residents presenting mental, intellectual or physical disabilities [72]. This reference presents an interest for the design of a psychosocial rehabilitation center through its organization around courtyards, its continuous pathways, its activity spaces and its security devices that preserve views, as shown in Fig. 17.



Fig 17 Aerial View of the Hangzhou Social Welfare Institute No. 1.
Source: ArchDaily, 2024.

The parti architectural establishes a relationship between the project, the landscape and local culture, drawing on the jade symbol of Liangzhu culture, an inner circle inscribed within an outer square, translated into buildings grouped around courtyards, each unit organized around a central courtyard following a courtyard-within-courtyard principle. Buildings are linked by covered galleries, and circulation forms continuous rectangular pathways rather than dead-end corridors, reducing blind spots and disorientation risks. Security is ensured without giving rooms a carceral appearance: metal bars are replaced by laminated, reinforced insulating glazing that preserves views toward the landscape, complemented by decorative grilles and

transparent metallic mesh. The primary limitation of this reference concerns the difference between the population received, largely composed of people with disabilities requiring long-term residence, and refugees suffering from war trauma, as well as the difference between its mountainous, humid climate and the hot, dry climate of Maroua.

➤ *Tambacounda Hospital (Senegal)*

Although not a psychiatric hospital, the Tambacounda Hospital, designed by Manuel Herz Architects and completed in 2021 on a 3,000 m² site in Tambacounda, Senegal, is retained for the strength of its architectural expression, combining modernity and respect for local traditions. The use of local materials, adaptation to the climatic and cultural realities of Tambacounda, and the treatment of thermal comfort and air circulation address challenges close to those encountered in the Far North region of Cameroon, constituting a source of inspiration for a durable and contextualized response to public health needs [73], as shown in Fig. 18.

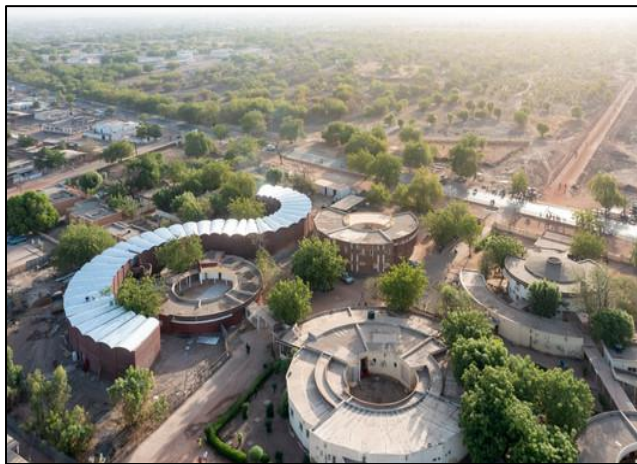


Fig 18 Tambacounda Hospital, Senegal.
Source: ArchDaily, 2022.

The parti architectural rests on a functional and contextual approach: the hospital is organized in pavilions around a central courtyard, favoring natural ventilation and fluid circulation for patients and staff, while cantilevered roofs and openings produce indispensable shading to mitigate the intense heat of the Sahelian climate. The courtyard device maximizes natural aeration and reduces the impact of high heat, the structure following the topography and harmonizing with the landscape. Rooms are constantly aerated and protected from high temperatures through a double-skin system that reinforces thermal protection, improves natural ventilation and produces a specific aesthetic linked to brick patterning. The use of local materials, notably concrete and earth in the form of bricks, renders the environment familiar for patients, visitors and staff, the contrast between the red of the bricks, symbolically associated with the bond of blood in the maternity ward, and the white of the concrete, associated with the calm of sanitary environments, participating in a human-centered aesthetic. Rainwater management is not described as optimal, a limitation that better recovery could address as an alternative water supply for the locality.

VII. DISCUSSION: TOWARD AN ARCHITECTURAL MODEL FOR MAROUA

The confrontation of the theoretical literature with the analysis of the three precedents converges toward a set of findings that collectively define the design problem. On the diagnostic level, war trauma and exile do not follow mechanically from violent exposure, since effects depend on subjective experience and context, which imposes an adaptable, non-stigmatizing architecture capable of offering genuine choices of use rather than a uniform therapeutic prescription. The literature highlights the interest of Evidence-Based Design and trauma-informed approaches, as well as the contributions of environmental psychology on restorative environments, light, views and nature, and on the reduction of stress and aggression, confirming that space can support emotional stabilization and the progressive resumption of social ties.

Several structuring design devices emerge from this convergence: wayfinding legibility, controlled exposure, withdrawal spaces, public-transition-private gradation, prospect-refuge balance, calming materiality and atmospheres, indoor-outdoor continuity, and the presence of nature. The three analogous references confirm the relevance of these principles while recalling important limitations: transfers from foreign contexts are sometimes delicate, budgetary and climatic constraints are significant, tensions exist between security and privacy, and the effectiveness of architecture remains dependent on care organization and human resources. Applied to the peri-urban context of Maroua, these principles imply an architecture adapted to a hot and dry climate, grounded in locally available materials and construction techniques, and organized around a gradation of spaces capable of accompanying refugees from initial reception to progressive social reintegration.

VIII. CONCLUSION

This review has clarified the theoretical and operational foundations of therapeutic architecture applied to war trauma, with a view to designing a psychosocial rehabilitation center for refugees in the peri-urban area of Maroua. It emerges that such a project cannot be reduced to a functional response: it must spatially translate the requirements of care and recovery, articulating architectural programming, psychological security, sensory comfort and dignity. The literature demonstrates the interest of Evidence-Based Design and trauma-informed approaches, as well as the contributions of environmental psychology on restorative environments and the reduction of stress and aggression, confirming that space can support emotional stabilization and the progressive resumption of social ties.

Several design devices emerge as structuring: wayfinding legibility, controlled exposure, withdrawal spaces, public-transition-private gradation, prospect-refuge balance, calming materiality and atmospheres, indoor-outdoor continuity and the presence of nature. In parallel, the analysis of war trauma and exile shows that violence does not mechanically produce trauma, effects depending on

subjective experience and context, which imposes an adaptable, non-stigmatizing architecture capable of offering choices of use. The case studies examined confirm the relevance of these principles while recalling important limitations, including delicate transfers from foreign contexts, budgetary and climatic constraints, tensions between security and privacy, and the dependence of architectural effectiveness on care organization and human resources. This theoretical foundation grounds the subsequent translation of these findings into an architectural parti and spatial devices adapted to the context of Maroua.

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